Row Operations

Types of systems:

2D $\mathbb{R}^2$::

- Non-parallel lines
- Identical lines
- Parallel lines

3D $\mathbb{R}^3$:

- Unique solution
- Infinite number of solutions
- No solutions

Row operations:

- (Replacement/ Addition) Add a multiple of one row to another.
- (Interchange) Interchange two rows.
- (Scaling) Multiply a row by a non-zero scalar.

$$\begin{cases} x_1 - 2x_2 + x_3 = 0 \\ 2x_2 - 8x_3 = 8 \\ 5x_1 - 5x_3 = 10 \end{cases}$$

$\text{Row}_1 + \text{Row}_2$

$$\begin{cases} x_1 - 7x_3 = 8 \\ 2x_2 - 8x_3 = 8 \\ 5x_1 - 5x_3 = 10 \end{cases}$$

$\text{Row}_2 / 2$

$$\begin{cases} x_1 - 7x_3 = 8 \\ x_2 - 4x_3 = 4 \\ 5x_1 - 5x_3 = 10 \end{cases}$$

$\text{Row}_3 - 5\,\text{Row}_1$

$$\begin{cases} x_1 - 7x_3 = 8 \\ x_2 - 4x_3 = 4 \\ 10x_2 - 10x_3 = 10 \end{cases}$$

**Note: Row_1 represents the original Row_1 not the modified Row_1

Row$_3$ - 10 Row$_2$

$$\begin{cases} x_1 - 7x_3 = 8 \\ x_2 - 4x_3 = 4 \\ 30x_3 = -30 \end{cases}$$

$$x_3 = -1$$

Substiution

$$x_1 = 1$$

$$x_2 = 0$$